Earth observations informing energy management: NASA research supporting interagency and international initiatives

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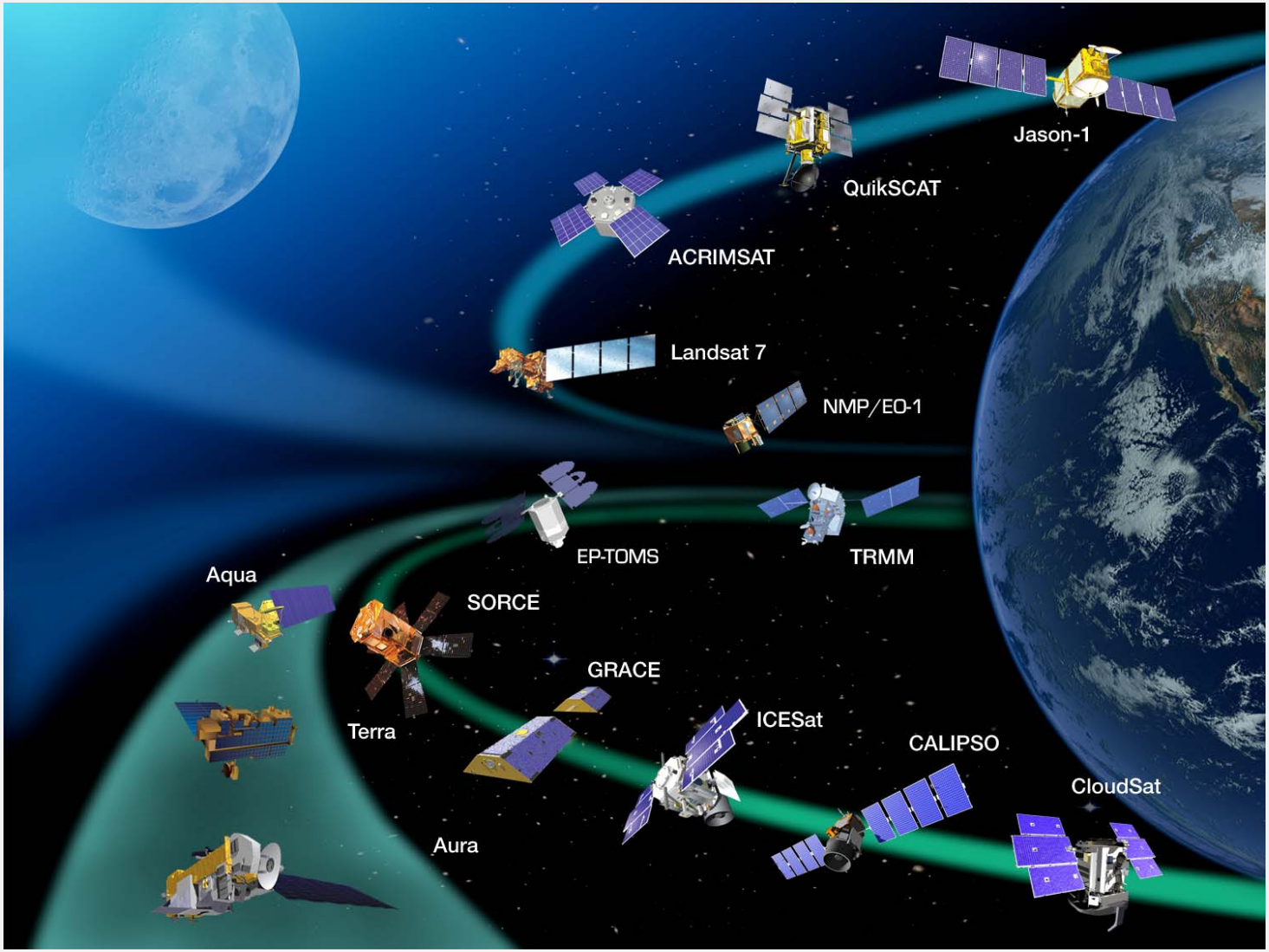
Outline

- **NASA Applied Sciences Program:** ***Overview***
- **International Initiatives:** ***GEOSS, GEO, and CEOS***
  - An alphabet soup of international efforts
- **Interagency Initiatives:** ***CCSP and CCTP***
- **Conclusions:** ***Where do we go from here?***

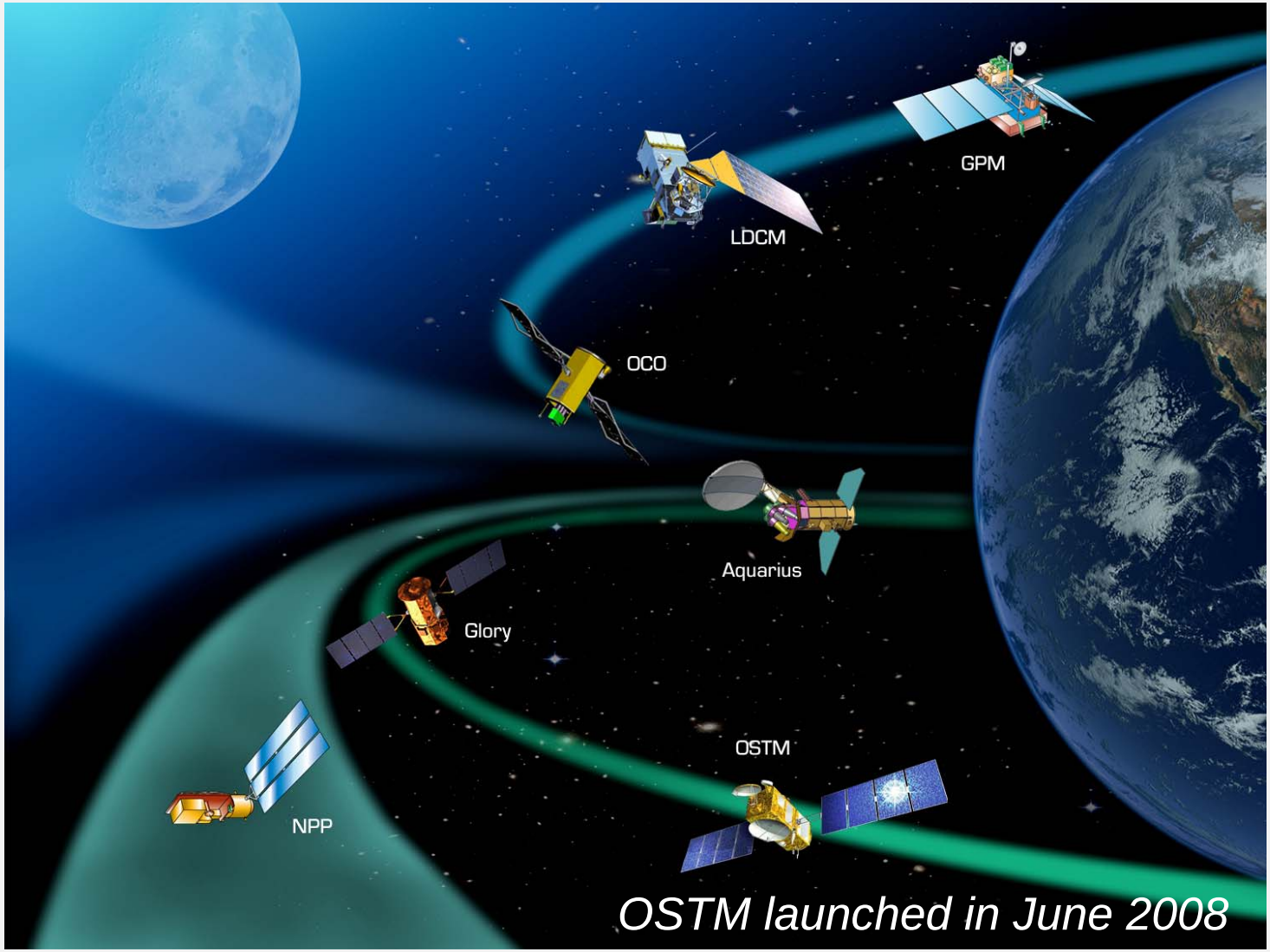
NASA Applied Sciences Program

- ***Overview***

NASA Earth Observing Satellites



Future Earth Observation Satellites



NASA Applied Sciences Program

- ***Applied Sciences Goal:*** **The Applied Sciences program extends NASA Earth Science research and observations for practical use in environmentally-related decision and policy making.**

- ***Serves society through:***
  - Demonstrating, through partnerships with public organizations, improvements to their ability to manage and plan natural resources and to make better environmental predictions, decisions, and policy.
- ***Serves the Earth science community by:***
  - Demonstrating and communicating the utility and potential of Earth science for societal benefit to a broad audience
  - Complementing R&A programs through applied research in strategic areas
  - Providing the applications "viewpoint" to the research community (e.g., working with CCSP, CCTP, GEO, and CEOS)
  - Forging partnerships with "nontraditional" organizations (e.g., NREL, USDA, Battelle, NRCan, ESA, DLR, Universities, Private Sector)

Societal Benefit Areas

Applied Sciences aligns with GEO Societal Benefit Areas, with a focus on those areas where:

- NASA has capability and expertise
- NASA can have greatest impact
- Societal need is greatest

Disaster Management

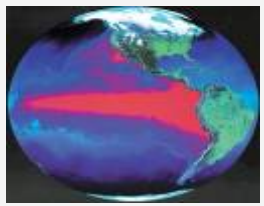
Public Health

Weather

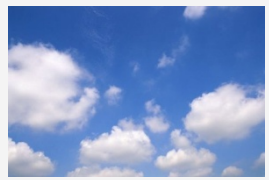
Water Resources

Ecosystems

Agriculture



Climate



Air Quality

International Initiatives

- ***GEOSS, GEO, and CEOS***
  - An alphabet soup of international efforts

Group on Earth Observations (GEO)

- **GEO is coordinating efforts to build a Global Earth Observation System of Systems (GEOSS)**

- **Launched in response to calls for action by the 2002 World Summit on Sustainable Development and by the G8 (Group of Eight) leading industrialized countries**

- **GEO is a voluntary partnership of 74 governments, the Europe and 51 international organizations**

Group on Earth Observations (cont'd.)

- **GEO is constructing GEOSS on the basis of a 10-Year Implementation Plan for the period 2005 to 2015 (available at www.earthobservations.org)**

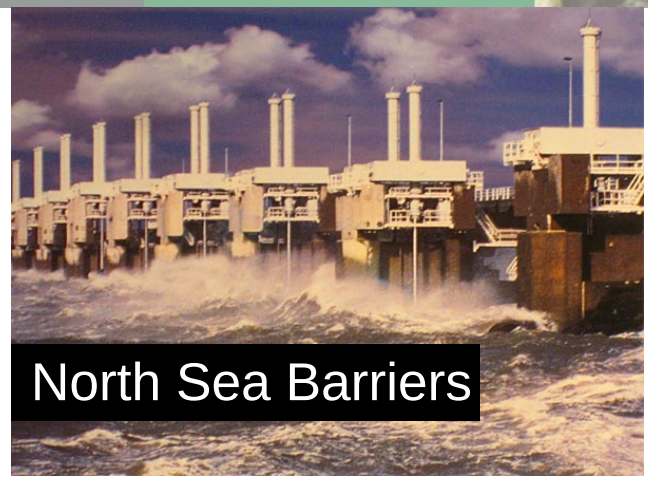
- **Plan defines a vision statement for GEOSS, its purpose and scope, expected benefits, and the nine "Societal Benefit Areas" of disasters, health, *energy*, *climate,* water, weather, ecosystems, agriculture and biodiversity**

Group on Earth Observations

Importance of Earth Observation Data

- We Must Promote Societal Benefits of Integrated Observations

UK Flooding



North Sea Barriers

Many Systems Contributing to GEOSS

- Monitoring for scientific, economic, & societal benefits
- Focus on policy needs
  - Society needs information & services—beyond data
- GEO is logical outlet
  - Countries
  - Institutions
- Draw from previous work
  - IGOS, CEOS, WMO, G3OS

U.S. IEOS

GMES

GEOSS

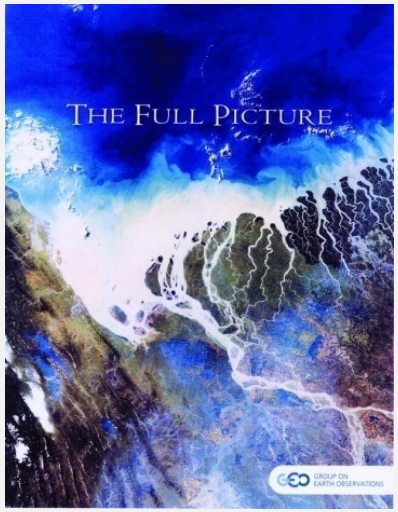
2007-2009 Planning: Highlights

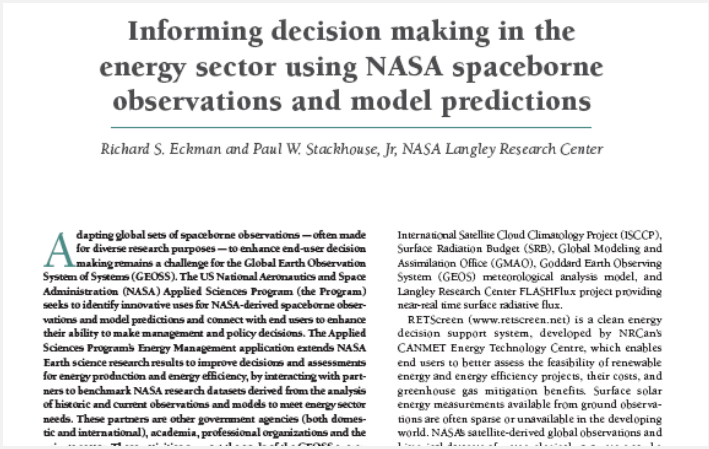
Renewable Energy – Managing Uncertainty

- Developing applications for monitoring renewable energy sources
- Improving forecasting of fluctuations and intermittency
- Promoting collaboration among users and providers

NASA Energy Program Contributions to GEO and CEOS

- ***Core member of GEO energy community of practice***
  - Applied Sciences-funded activities contribute directly to GEO work plan tasks EN06-04, EN07-01, EN07-03
  - IEA activity, leveraged with ESA partnership, provided first **GEO energy early achievement project,** "Solar Information for Developing Countries"
  - One of principal authors of **GEO Energy Strategic Plan**, which closely mirrors Applied Sciences Program plan
  - **Lead for CEOS Energy SBA** activities (GEO-CEOS remapping activities)
  - Energy articles published in **GEO summit publication** (two with NASA involvement)





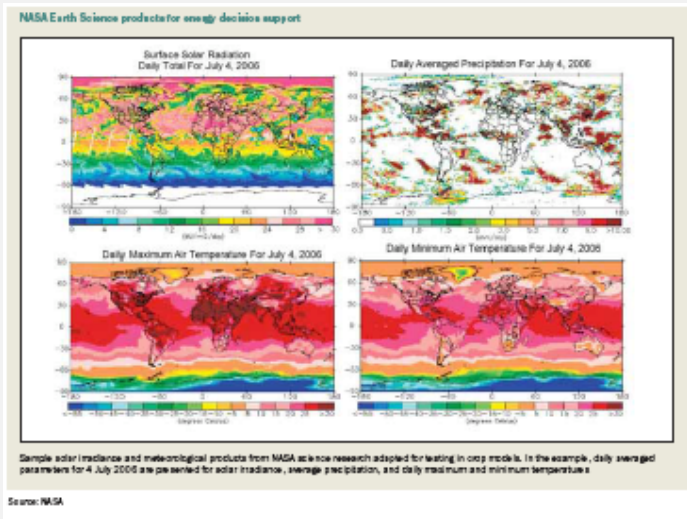
Informing decision making in the energy sector using NASA spaceborne observations and model predictions

Richard S. Eckman and Paul W. Stackhouse, Jr, NASA Langley Research Center

Adapting global sets of spaceborne observations — often made for diverse research purposes — to enhance end-user decision making remains a challenge for the Global Earth Observation System of Systems (GEOSS). The US National Aeronautics and Space Administration (NASA) Applied Sciences Program (the Program) seeks to identify innovative uses for NASA-derived spaceborne observations and model predictions and connect with end users to enhance their ability to make management and policy decisions. The Applied Sciences Program's Energy Management application extends NASA Earth science research results to improve decisions and assessments for energy production and energy efficiency, by interacting with partners to benchmark NASA research datasets derived from the analysis of historic and current observations and models to meet energy sector needs. These partners are other government agencies (both domestic and international), academia, professional organizations and the

International Satellite Cloud Climatology Project (ISCCP), Surface Radiation Budget (SRB), Global Modeling and Assimilation Office (GMAO), Goddard Earth Observing System (GEOS) meteorological analysis model, and Langley Research Center FLASHFlux project providing near-real time surface radiative flux.

RETScreen (www.retscreen.net) is a clean energy decision support system, developed by NRCan's CANMET Energy Technology Centre, which enables end users to better assess the feasibility of renewable energy and energy efficiency projects, their costs, and greenhouse gas mitigation benefits. Surface solar energy measurements available from ground observations are often sparse or unavailable in the developing world. NASA's satellite-derived global observations and

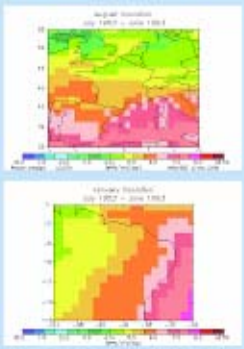


Group on Earth Observations

GEOSS: First Energy Demonstration

SSE Data Set

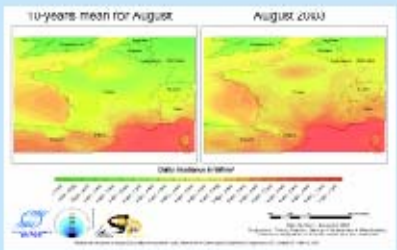
Access through:
http://eosweb.larc.nasa.gov/sse/



- Monthly averaged from 11 years of data (1983-1993)
- Data tables for a particular location
- Color plots on both global and regional scales
- Over 200 satellite-derived meteorology and solar energy parameters
- Data for the RETScreen® Clean Energy Project Analysis Software

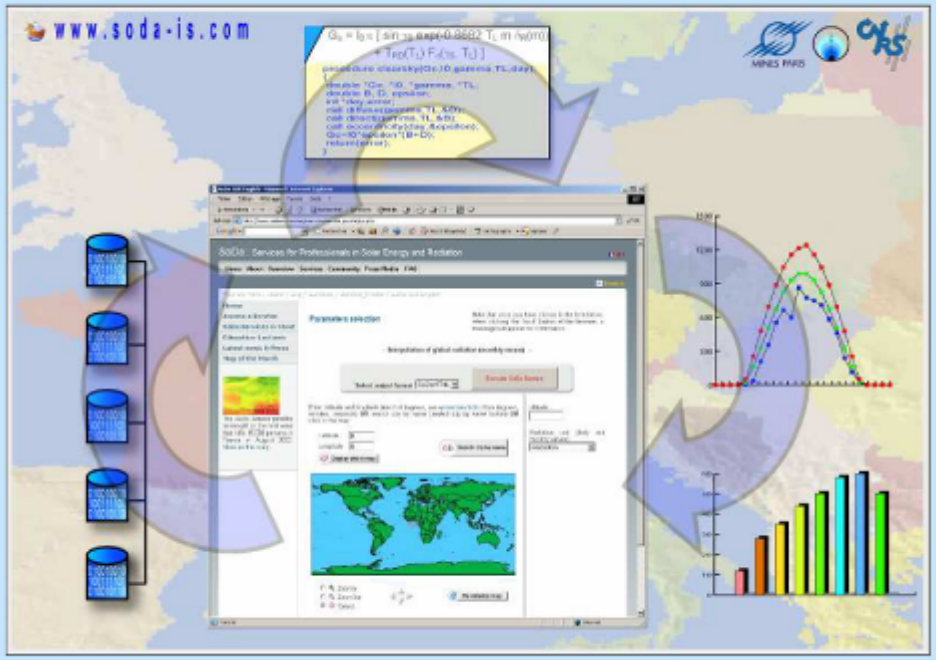
Helioclim Database

Access through SoDa:
http://www.soda-is.com/



- Database and time-series of irradiance or irradiation
- Produced by the processing of satellite images, especially from the Meteosat series of satellites
- Covering Europe, Africa, the Mediterranean Basin, the Atlantic Ocean and part of the Indian Ocean
- Period runs from 1985 onwards

The SoDa Service Integrator



Hosted by École des Mines de Paris

Committee on Earth Observation Satellites

- **Committee on Earth Observation Satellites (CEOS) is the international coordinating mechanism charged with coordinating international civil spaceborne missions designed to observe and study planet Earth**
- **26 member space agencies and 20 associates organizations**
- **CEOS is implementing the space-based tasks of GEOSS, working closely with the GEO Secretariat**

CEOS 2007 Progress Summary

- Strategic plan (26): The **strategic plan** has been finalized by the Energy Community of Practice and is being submitted to GEO Cape Town
- Evaluation and revision of strategic plan (132): Implementation of elements of the Strategic Plan is already proceeding.
- New energy-tailored products and services (134): GEO Near-Term Demonstration Project, “Solar Energy Data for Developing Countries” was initiated with international collaboration. Other pilot and demonstration projects underway, funded by national and regional agencies, e.g. European ENVISOLAR project & NASA Applied Sciences Program (inform decision making in the Energy sector).
- **A US national assessment of energy-related Earth observations, models, and decision support systems, together with a stakeholder’s engagement workshop to assess the applicability of Earth observations and models to end-user needs has been conducted by NASA during 2007**

CEOS Plan for 2008 and beyond

- *The Strategic Plan for "Improving Management of Energy Resources" describes goals of GEO members, supporting activities, and recommended future actions. These align with GEO 2007-2009 work plan tasks – EN-07-01, EN-07-02, and EN-07-03. Activities at national level are presently occurring in these areas with pilot and demonstration projects conducted by Energy CoP member organizations.*

- As recommended in GEO Energy Strategic Plan, analyses of nation's space-borne measurement & modelling assets & decision support systems relevant to energy community should be performed by other nations. Action: China (NRSCC), Europe (ESA), India (ISRO), Japan (JAXA), Russia (ROSHYDROMET), South Africa (SAC), and other interested nations or regions.

- Further stakeholders workshops, of scientists & public/private sector end-users, to communicate availability of space-borne measurements relevant to energy community & to better understand user requirements, are encouraged (Action: Energy SBA coordinator to investigate).

- Long-term commitments to GEOSS & CEOS objectives need to be articulated by national/regional agencies to ensure continuing progress in GEO work plan goals. Non-traditional funding sources, e.g., from the private sector, should be explored, as appropriate (Action: Energy SBA coordinator to investigate).

- Richard Eckman (NASA) has agreed to serve as Energy SBA Coordinator

U.S. Interagency Initiatives

- ***CCSP and CCTP***

Climate Change Science Program

- **CCSP integrates Federal research on climate and global change, as sponsored by thirteen federal agencies and overseen by OSTP, CEQ, and OMB**
- **Launched in 2002 by Bush administration, taking in US Global Change Research Program (USGCRP) and Climate Change Research Initiative (CCRI)**
- ***Mission Statement:* Facilitate the creation and application of knowledge of the Earth's global environment through research, observations, decision support, and communication.**
- **Interagency working groups (by discipline, e.g., atmospheric composition)**

Climate Change Technology Program

- **CCTP is a multi-agency planning and coordination entity, whose mission is to strengthen the Federal research and development portfolio across more than a dozen participating agencies**
- ***Mission:* Accelerate the development and deployment of technologies that can reduce, avoid, or capture and store greenhouse gas emissions**
- **Six interagency working groups formulated its Strategic Plan, released in 2006 (available at www.climatetechnology.gov)**
- **NASA leads Measurement and Monitoring working group**

Conclusions

- **NASA Science Mission Directorate energy application activities primarily carried out by Applied Sciences Program climate element**
- **Close collaboration with international partners (ESA, DLR, European universities) facilitated by GEO and CEOS**
- **Interagency collaboration (notably with NOAA, DOE, EPA, USGS) facilitated by CCSP and CCTP**
  - **CCSP and CCTP are both in the process of conducting strategic reviews to assess progress, consider closer collaboration, and move forward under a new administration**